

TRANSMISSION ADAPTATION

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a divisional application of U.S. patent application Ser. No. 14/413,763 (filed on Jan. 9, 2015; now allowed) which is a US national stage entry of International Patent Application PCT/EP2012/066573 (filed Aug. 27, 2012). The entire contents of these two priority applications are hereby incorporated by reference.

FIELD

[0002] The invention relates to apparatuses, methods, systems, computer programs, computer program products and computer-readable media.

BACKGROUND

[0003] The following description of background art may include insights, discoveries, understandings or disclosures, or associations together with disclosures not known to the relevant art prior to the present invention but provided by the invention. Some such contributions of the invention may be specifically pointed out below, whereas other such contributions of the invention will be apparent from their context.

[0004] The long term evolution (LTE) standard is designed to use a combination of multiple-input multiple-output (MIMO) and orthogonal frequency division multiplexing (OFDM) to offer better performance in terms of capacity, diversity and bandwidth efficiency. LTE subcarriers are usually received with different quality levels due to frequency selective fading, which causes the subcarriers to vary over time, frequency and/or spatial dimensions. This behavior may be exploited by using link adaptation. The link adaptation usually refers to techniques of selecting the best modulation, coding and rank scheme (MCRS) as well as a precoding matrix for a current channel state for optimizing performance under a certain constraint such as a frame error rate (FER).

BRIEF DESCRIPTION

[0005] According to an aspect of the present invention, there is provided an apparatus comprising: at least one processor and at least one memory including a computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: choose a modulation, coding and rank scheme, determine a channel quality indicator based on the modulation, coding and rank scheme, and add a detector class indicator to the channel quality indicator for informing capability to the high order modulation, if a high order modulation is chosen.

[0006] According to an aspect of the present invention, there is provided an apparatus comprising: at least one processor and at least one memory including a computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the apparatus at least to: obtain a channel quality indicator comprising a detector class indicator informing transmitter's capability to a high order modulation, and substitute the modulation, coding and rank scheme utilizing the high order modulation with a modulation, coding and rank scheme utilizing a lower order modulation and provid-

ing nearest similar performance, if the high order modulation is not supported by a receiver.

[0007] According to yet another aspect of the present invention, there is provided a method comprising: choosing a modulation, coding and rank scheme, determining a channel quality indicator based on the modulation, coding and rank scheme, and if a high order modulation is chosen, adding a detector class indicator to the channel quality indicator for informing capability to the high order modulation.

[0008] According to yet another aspect of the present invention, there is provided a method comprising: obtaining a channel quality indicator comprising a detector class indicator informing transmitter's capability to a high order modulation, and if the high order modulation is not supported by a receiver, substituting the modulation, coding and, rank scheme utilizing the high order modulation with a modulation, coding and rank scheme utilizing a lower order modulation and providing nearest similar performance.

[0009] According to yet another aspect of the present invention, there is provided an apparatus comprising: means for choosing a modulation, coding and rank scheme, means for determining a channel quality indicator based on the modulation, coding and rank scheme, and means for adding a detector class indicator to the channel quality indicator for informing capability to the high order modulation, if a high order modulation is chosen.

[0010] According to yet another aspect of the present invention, there is provided an apparatus comprising: means for obtaining a channel quality indicator comprising a detector class indicator informing transmitter's capability to a high order modulation, and means for substituting the modulation, coding and rank scheme utilizing the high order modulation with a modulation, coding and rank scheme utilizing a lower order modulation and providing nearest similar performance, if the high order modulation is not supported by a receiver.

[0011] According to yet another aspect of the present invention, there is provided a computer program embodied on a computer-readable storage medium, the computer program comprising program code for controlling a process to execute a process, the process comprising: choosing a modulation, coding and rank scheme, determining a channel quality indicator based on the modulation, coding and rank scheme, and if a high order modulation is chosen, adding a detector class indicator to the channel quality indicator for informing capability to the high order modulation.

[0012] According to yet another aspect of the present invention, there is provided a computer program embodied on a computer-readable storage medium, the computer program comprising program code for controlling a process to execute a process, the process comprising: obtaining a channel quality indicator comprising a detector class indicator informing transmitter's capability to a high order modulation, and if the high order modulation is not supported by a receiver, substituting the modulation, coding and rank scheme utilizing the high order modulation with a modulation, coding and rank scheme utilizing a lower order modulation and providing nearest similar performance.

LIST OF DRAWINGS

[0013] Some embodiments of the present invention are described below, by way of example only, with reference to the accompanying drawings, in which